

This text is an amplification of the memoir that was published in the Annual Review of Genetics, 1987. It fills out more detail on developmental influences that have shaped my thought. It is an early draft of a chapter that I am planning for inclusion in my Yale Terry lectures, presented in Spring 1989, but scheduled for publication in 1991. My account will bear many resemblances, and many contrasts, with the careers of other generational peers, Jewish boys of impecunious origins from New York City (in fact, I was born in Montclair, N.J.)

When I was born in 1925 my parents were recent immigrants from Palestine (Israel). They had been born (1903) under the Ottoman sultanate; from 1917 on, Palestine was ruled by the British military occupation and then by League of Nations mandatory authority. The Balfour declaration (of the Jewish homeland in Israel) was unimplemented rhetoric; and post World War I economic and ethnic community relations under the British regime were if anything worse than under the sultanate. Both my parents' genealogy sparkled with the names of revered rabbinical figures. They had stemmed from pre-Zionist pilgrimages to the Holy Land from the Russian Pale, from Poland to Bessarabia. From the 1850s onward there had been active British and French diplomatic interest in Palestine awaiting the demise of the Turkish "sick man of Europe" and to thwart Russian influence. Jerusalem was a busy cosmopolitan center, not to be compared with the isolation of the central European shtetl.

do you know of sources on the shtetl in Palestine?

My parents finally immigrated to Montclair, New Jersey in 1924 -- a date after the restrictive immigration laws. But my father had acquired entry rights upon a prior study trip to New York City in 1921. He would already have studied English and become fluent in Hebrew and Arabic and a smattering of Yiddish in Jerusalem.

Although penniless, my father's status as a "Yeshiva Bocher" a brilliant seminary graduate from Israel, gave him an aristocratic standing familiar to the tradition of the shtetl, the social background of the congregations who engaged him. I have no doubt this was my indoctrination with the perspective that learning is the key to esteem, to achievement, to self-worth (Jews' "respect for learning" should not be confused with the idea that every secular pursuit takes it for granted within its own practitioners {Feuer}). But even, perhaps especially, the most uncultivated of successful businessmen had a regard for learning on the part of others that transcended their pride in wealth, and in a way seen less today in other nouveaux riches.

My family moved to New York City (Washington Heights) within a few months after I was born; my father took a position in a small orthodox synagogue, Ahavat Israel: its records are replete with annotations "treasury empty; can't pay rabbi". But my parents eked out a living like that of a country parson with gifts in kind and fees for officiating at weddings and funerals. Many a ceremonial glass was crushed under the bridegroom's heel under a chupah in our own apartment, after the marriage contracts had been signed by the groom and the bride's parents. And my mother chipped in teaching Hebrew in the Cheder.

My young brother Seymour arrived with I was three and a half; his advent spared me from being an only child (he is today a professor of biology at Brown University). His presence introduced me to executive responsibilities, whilst my parents were fully occupied

bringing home what must not be called the bacon.

I was a precocious child, though no John Stuart Mill; nor did I have a relentless teacher for a father, who would take me out of the routine of public education. By age seven I had written, nevertheless, of my ambition "to be a scientist like Einstein" and I have been singlemindedly involved in science ever since. My father did play a deeper role, essentially that of religious inspiration for that calling.

The precocity was enough to attract positive and reinforcing attention, and to generate some problems in the management of my education in the N. Y. City Public Schools. Happily, some extraordinarily sympathetic teachers honored the limitations of the formal curriculum and offered kindly guidance to my own reading as an alternative to boring classroom drill. My part of the contract was to not disrupt them. That precocity also shaped an intellectual and emotional isolation, especially from my age-peers, that only began to be dissipated at a life stage when age no longer mattered. How I would have ached for a mentor then, for a chance to meet a Member of the Rockefeller Institute for Medical Research! (Not till Columbia College did I find an affiliation with a working scientist, long after I had firmly crystallized my career plans. So that most important of life decisions was made by an infant, with no informed guidance from any experienced adult. At age 11 I was teaching myself calculus and organic chemistry, at 12-13 biochemistry and history and philosophy as well, mostly through the local NY Public Library and the stack privileges generously granted me at Cooper Union.

Like many other second-generation Jewish youths in New York City, I was an eager recruit in an efficient and calculated system of Americanization, fostered by the rich opportunities and incentives of the educational system. Stuyvesant High School wonderfully illustrated these melting-pot objectives. Regardless of neighborhood residence, it is open by competitive examination to students with a bent for science and technology. It offers unusual opportunities for practical work in machine shops and analytical laboratories as well as straight classroom teaching that reach early college level in science. Most important of all, it attracts a peer group (then unfortunately limited to boys) of the keenest young intellects. These were surely as important as my teachers in the development of cognitive skills, and for the first time I had a few friends with whom to play intellectual games at par. Its graduates have achieved disproportionate representation in academic life; I repeatedly encounter my old classmates in positions of importance throughout the country. I am also startled to see a few names in the class yearbook who I thought had extraordinary gifts not matched by their evident later achievement. What limitation in their gifts, or what accidents in their development, will account for that disappointment? In medicine, we know that pathology is often the best clue to normal function, and similar studies are needed in the field of creative development.

Generationally, I was fortunately placed: my teachers were already successors to an earlier era of patronizing condescension to the wave of Eastern European immigrants. Many of them were Jewish; all were inculcated with ethnic neutrality, and liberal minded tolerance: attitudes conveyed to their students. {Cf. Brumberg "Going to America, Going to School"}. Had I been 5 years older, I would have been at risk of being recruited by the wave of radicalism, born of the despair of the depression, that has characterized that cohort of "New York

Intellectuals", many of them to swing equally far to the right after their faith in Stalinism had been so brutally dishonored. Instead, my learning of civics and economics was imbued with the liberal optimism of the New Deal, and of politics with the simple categoricals of the struggle against Hitler.

My earliest recollections aver an unswerving interest in science, as the means by which man could strive for understanding of his origin, setting and purpose, and for power to forestall his natural fate of hunger, disease and death. The Jewish reading in Genesis of the expulsion from Eden makes no presumptions of the benignity of Nature. "By the sweat of thy brow" This may have been the most acceptable deviation from the orthodox religious calling of my family tradition. These images were reinforced by the role of Albert Einstein and Chaim Weizmann as culture heroes - heroes whose secular achievements my parents and I could together understand and appreciate, regardless of the intergenerational conflicts evoked by my callow agnosticism. I could not then see how the monotheistic worldview and the central teachings of the Old Testament, and their ethical imperatives for contemporary life, related to the tribal rituals shaped in the Diaspora. But the utopian-scientific ethic offered an acceptable resolution. My own career could advance our shared ideals in a modern, American idiom. Science would be a path to knowledge of the cosmic order. It would also be a means of alleviating human suffering. The Jewish tradition is remarkably tolerant of skepticism. The sages were more insistent that ultimate questions be in mind, than that they be answered in the framework of a particular dogma. I have in mind, e.g., Maimonides' teachings of the unknowability of God. The agnostic set of mind thus permitted, together with my reaction to my father's orthodoxy, carried over into my reflex responses to other sources of authoritative knowledge. This was an integration, not a rejection of Jewish identity: what could be a more Jewish name than "Joshua"? and I have always borne it proudly.

Equally important as the schools to my own education was the local Washington Heights branch of the Carnegie- Astor New York Public Library system. These institutions symbolized and embodied the melting pot ideology. The library was my university as I went through grade school, junior high and Stuyvesant High School. Here was the universe of knowledge, huge but finite. The teen-ager, unencumbered by any informed guidance and tutelage, fantasized mastering all of it. There were few books (except perhaps musical scores) that were totally incomprehensible to me; most were merely difficult and would eventually yield to diligent study. At that age, of course, there is little sense of the finitude of human life. After 1938, I also had access to the Stuyvesant High School library, and more importantly Cooper Union, for its stacks gave access to scientific journals like the Journal of the American Chemical Society and Science magazine. The librarians did (and do) welcome me as their most enthusiastic patron; I loved nothing better than to scan the shelves, discipline by discipline, and try to find whatever work both challenged, and was accessible, to me. I was also a voracious reader of contemporary fiction.

The books that engaged me most deeply as a youth, before more advanced texts were accessible, were Eddington and Jeans on physics; inspirational works like Jaffe's "Crucibles", in chemistry. Wells, Huxley and Wells' encyclopedic 'The Science of Life'

was the most influential source of my perspective on biology and man's place in the cosmos,

seen as evolutionary drama. De Kruif's "Microbe Hunters" turned my entire generation towards a career in medical research. Albert Einstein and Chaim Weizmann were towering culture heroes. The ambitions they inspired were reinforced by a popular culture that idealized the medical scientist, novels and movies like *Arrowsmith*, *The Magic Bullet*, *The Life of Louis Pasteur*, and *The Symphony of Six Million*. In a mood born of the Great Depression, however, many of these works painted a bleak picture of the personal life of the scientist: marriage and family were expected to be Baconian "hostages to fortune".

Scientifically, the most important work I encountered at the library was Bodansky's *Introduction to Physiological Chemistry*. I successfully pleaded for it as a Bar Mitzvah present (1938). I first made note of it as a mark of precocity; but more importantly, it symbolizes my covenant with my father: that a career in science would be a redeeming surrogate for the study of Torah, an alternative approach to enlightenment and truth.

That copy stands on my book shelf today, the print almost worn off the pages. This text is medically oriented but covers intermediary metabolism very well, as well as the structure of amino acids and proteins. It also gives an excellent account of Garrod's work on Inborn Errors of Metabolism, studies on genetic defects in man that anticipated by many years the founding of biochemical genetics by Beadle and Tatum in 1941. This work was evidently overlooked by most geneticists, including Beadle, for some years thereafter, although it was part of the standard curriculum in medically oriented biochemistry. The second major work of possession was E. B. Wilson's, *The Cell*, but this not until 1941 for my 16th birthday. My autodidactic reading continued with growing intensity, and enabled me to take advanced standing in several science courses when I entered Columbia College.

The New York Museum of Science and Industry, and the NY World's Fair (starting 1939) were also wonderful stimuli, picturing science-technology utopias of the near future. They offered samples of polaroid optical sheets, and of the new bakelite plastics that could be taken home for further experiments. Above all they left a vision of "Better Things for Better Living Through Chemistry." (DuPont's slogan now leaves out the word chemistry -- it has become a dirty word!)

One of the guides at the New York World's Fair was a young psychologist, Henry Platt. He had a vision of a means of encouraging young scientific minds, namely to offer them a laboratory where they could conduct authentic scientific research, with appropriate equipment and supervision. By lucky chance, he met Thomas J. Watson at the Fair, and persuaded him to support the project. This materialized as the American Institute of Science Laboratory, housed in an IBM showroom building on Fifth Avenue, in the shadow of the Empire State Building. I was lucky to be accepted into that program: having graduated from High School in January, and being obliged to wait until September to start at Columbia, it was a happy way indeed to occupy the interval. And I was too young to work without running afoul of the child labor laws! If I remind you that its two score registrants included Barry Blumberg and Charles Yanofsky, you will agree what a positive premonition AISL was for the next generation of science. The laboratory did indeed offer better facilities, and unbroken time, to continue the cytochemical work I started at Stuyvesant; and I begin to focus on the chemistry of the nucleolus. It had many of the properties of nucleic acids, but not consistent with being pure DNA. (My own studies were hardly contributory to a solution: Brachet had already

applied ribonuclease to the histochemical identification of RNA in nucleoli. His work, published in Nazi-occupied Brussels in November 1940, was not communicated to the U. S. until some time later). The work did confirm my fascination with the chemistry of the cell, and I determined to concentrate on such studies as soon as I could acquire the authentic and mature expertise that Columbia could offer.

Before entering Columbia College, however, I had not yet met a working scientist. I can recall having attended popular lectures by Wendell Stanley, on the chemistry of tobacco mosaic virus; earlier, as a ten-year old, how impressed I had been by the newspaper accounts of his having "crystallized life" {cf. Lila Kay}. These stories were among many accounts that pointed to the Rockefeller Institute as the sanctum sanctorum of biomedical science.

With these cardinal inspirations, my entry to Columbia in September, 1941 was motivated by a passion to learn how "to bring the power of chemical analysis to the secrets of life". I looked forward to a career in medical research where such advances could be applied to problems like cancer and the malfunctions of the brain.

I had applied to Cornell, on account of Leslie Sharp's presence on the faculty - a name that I knew from his Textbook of Cytology. But Cornell was in practice open only to wealthy tuition-paying students, or to farm boys who could enroll in the N.Y. State funded College of Agriculture. My application for a scholarship at Telluride House was rejected. I also had City College in mind, but thought of this as a last resort, as it had limited graduate work, and scarcely any research facilities. No one so much as hinted that I could seek work and scholarships at other state universities. Berkeley might have been a superb possibility, but California seemed like the other side of the moon. Financially, a commuter school like Columbia was almost the only feasible possibility, barring a scholarship. This perhaps did not exist for a Jewish boy from New York at that time. Numerous Nobel Prizes have emerged from New York's science high schools and City Colleges. But they are witness of the encouragement given to the talent and ambition of its students, certainly more than of the laboratory facilities or of the academic attainments of their faculty at the time. I was fortunate indeed to win a scholarship that made it possible for me to attend Columbia, where I could have first hand attention from accomplished scientists. This was at a time when the private universities still entertained restrictive quotas on admission of New York City Jews, yes even in New York City institutions.

Hitler had achieved power in Germany when I was eight years old, just old enough to have no doubt about the aims of his march across Europe. Eight years of fascinated horror at the unfolding of history followed -- the persecution of the German Jews, the flight of intellectuals like Albert Einstein, the occupation of Austria, Munich, the Nazi-Soviet pact and partition of Poland, the fall of France, the victory of the RAF in the Battle of Britain, the Nazi invasion of Russia, the Japanese attack on Pearl Harbor. Then, in December 1941, we knew that the War would dominate our lives until a painful victory was won.

---- Footnote: ref. to Navy V-12 My debt to the Navy for sponsoring my education, and to my age peers who served in combat can hardly be discharged. That sense of obligation, and the generational scar of the costs of unpreparedness, of the delusions of unilateral disarmament, continue to mark my ongoing volunteer service on consulting bodies like the Defense Science Board and the Chief of Naval Operations' executive panel.

See Ann. Rev. Genetics for further detail.